EVALUATION OF TEST METHODS FOR STIFFNESS PROPERTIES OF HOT MIX ASPHALT (HMA)

Report Number: K-TRAN: KU-01-3

By
Stephen A. Cross, P.E., Oklahoma State University*
*current affiliation

RESEARCH

Introduction

The current *1993 AASHTO Design Guide for Design of Pavement Structures* uses resilient modulus to assign an "a" coefficient to hot mix asphalt (HMA) to determine the required thickness of the HMA layer for a given traffic loading and subgrade support condition. There are several methods to determine the modulus of a mix for use in determining the "a" coefficient. These methods include the procedure developed as a part of the Strategic Highway Research Program (SHRP). The current "a" coefficients used by the Kansas Department of Transportation (KDOT) were developed prior to the new Superpave mixture compaction protocols of AASHTO TP 4.

Project Objective

There are several methods currently being used to determine the stiffness properties of HMA, each with their own advantages and disadvantages. The most common methods include direct measurement using cylindrical specimens and indirect measurement using either external total horizontal deflection or inner horizontal and vertical deflection.

Project Description

The scope of this project consisted of evaluating the test data from stiffness or modulus testing of two KDOT mixtures using a direct method and two indirect methods. One indirect method used total external horizontal deflections and the other both inner horizontal and inner vertical deflections. In addition, two experimental procedures were evaluated; they were a direct measurement procedure using a GeoGauge™ and a pulse-velocity procedure described in ASTM C 1383 and ASTM C 597.

Project Results

The study was terminated by KDOT prior to completion of the initial test plan with the major reason being the emphasis being placed on complex dynamic modulus by the forthcoming 2002 Design Guide. Therefore, some limited conclusions can be drawn from the study. The short-term oven aging procedure described in AASHTO TP 4 resulted in higher modulus values than reported in the *1993 AASHTO Design Guide for Design of Pavement Structures*. The **direct** method gave similar results to the pulse-velocity procedures of ASTM C 1383 and **ASTM C 597**, indicating the potential for a simplified procedure for determining modulus of HMA. The indirect procedure of **ASTM D 4123** gave similar results to the more complicated **SHRP** procedure. The **SHRP** procedure has been reported as more precise. The coefficient of variation was similar, 21.8% for **ASTM D 4123** compared to 24.2% for the **SHRP** procedure. Evaluation of the precision of the test methods was outside the scope of this study. Percent compaction had a significant effect on modulus with low compaction, 90 and 93 percent Gmm, affecting the modulus to a higher degree than high compaction, 98 percent Gmm. Based on the very limited experiment, asphalt content did not have a significant effect on modulus.

Report Information

For technical information on this report, please contact: Glenn A. Fager, P.E., District Materials Engineer, District One, KDOT; 121 West 21st Street, Topeka, Kansas 66605-0128; Phone: 785-296-3881; Fax: 785-296-3720; e-mail: glenn.fager@ksdot.org.

For a copy of the full report, please contact: KDOT Library; 700 SW Harrison Street, Topeka, Kansas 66603-3754; Phone: 785-291-3854; Fax: 785-291-3717; e-mail: library@ksdot.org.